Bestowed Existence

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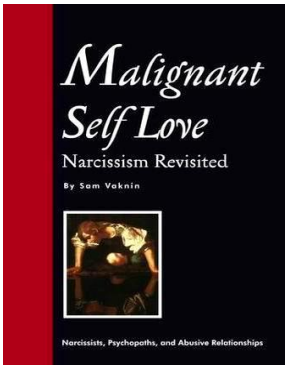

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I. Do Numbers Exist?

Knives and forks are objects external to us. They have an objective - or at least an intersubjective - existence. Presumably, they will be there even if no one watches or uses them ever again. We can safely call them "Objective Entities".

Our emotions and thoughts can be communicated - but they are ***NOT*** the communication itself or its contents. They are "Subjective Entities", internal, dependent upon our existence as observers.

But what about numbers? The number one, for instance, has no objective, observer-independent status. I am not referring to the number one as adjective, as in "one apple". I am referring to it as a stand-alone entity. As an entity it seems to stand alone in some way (it's out there), yet be subjective in other ways (dependent upon observers). Numbers belong to a third category: "Bestowed Entities". These are entities whose existence is bestowed upon them by social agreement between conscious agents.

But this definition is so wide that it might well be useless. Religion and money are two examples of entities which owe their existence to a social agreement between conscious entities - yet they don't strike us as universal and out there (objective) as numbers do.

Indeed, this distinction is pertinent and our definition should be refined accordingly.

We must distinguish "Social Entities" (like money or religion) from "Bestowed Entities". Social Entities are not universal, they are dependent on the society, culture and period that gave them birth. In contrast, numbers are Platonic ideas which come into existence through an act of conscious agreement between ***ALL*** the agents capable of reaching such an accord. While conscious agents can argue about the value of money (i.e., about its attributes) and about the existence of God - no rational, conscious agent can have an argument regarding the number one.

Apparently, the category of bestowed entities is free from the eternal dichotomy of internal versus external. It is both and comfortably so. But this is only an illusion. The dichotomy does persist. The bestowed entity is internal to the group of consenting conscious-rational agents - but it is external to any single agent (individual).

In other words, a group of rational conscious agents is certain to bestow existence on the number one. But to each and every member in the group the number one is external. It is through the power of the ***GROUP*** that existence is bestowed. From the individual's point of view, this existence emanates from outside him (from the group) and, therefore, is external. Existence is bestowed by changing the frame of reference (from individual to group).

But this is precisely how we attribute meaning to something! We change our frame of reference and meaning emerges. The death of the soldier is meaningful from the point of view of the state and the rituals of the church are meaningful from the point of view of God. By shifting among frames of reference, we elicit and extract and derive meaning.

If we bestow existence and derive meaning using the same mental (cognitive) mechanism, does this mean that the two processes are one and the same? Perhaps bestowing existence is a fancy term for the more prosaic attribution of meaning? Perhaps we give meaning to a number and thereby bestow existence upon it? Perhaps the number's existence is only its meaning and no more?

If so, all bestowed entities must be meaning-ful. In other words: all of them must depend for their existence on observers (rational-conscious agents). In such a scenario, if all humans were to disappear (as well as all other intelligent observers), numbers would cease to exist.

Intuitively, we know this is not true. To prove that it is untrue is, however, difficult. Still, numbers are acknowledged to have an independent, universal quality. Their existence does depend on intelligent observers in agreement. But they exist as potentialities, as Platonic ideas, as tendencies. They materialize through the agreement of intelligent agents rather the same way that ectoplasm was supposed to have materialized through spiritualist mediums. The agreement of the group is the ***CHANNEL*** through which numbers (and other bestowed entities, such as the laws of physics) are materialized, come into being.

We are creators. In creation, one derives the new from the old. There are laws of conservation that all entities, no matter how supreme, are subject to. We can rearrange, redefine, recombine physical and other substrates. But we cannot create substrates ex nihilo. Thus, everything MUST exist one way or another before we allow it existence as we define it. This rule equally applies bestowed entities.

BUT: wherever humans are involved, springs the eternal dichotomy of internal and external. Art makes use of a physical substrate but it succumbs to external laws of interpretation and thus derives its meaning (its existence as *ART*). The physical world, in contrast (similar to computer programmes) contains both the substrate and the operational procedures to be applied, also known as the laws of nature.

This is the source of the conceptual confusion. In creating, we materialize that which is already there, we give it venue and allow it expression. But we are also forever bound to the dichotomy of internal and external: a ***HUMAN*** dichotomy which has to do with our false position as observers and with our ability to introspect. So, we mistakenly confuse the two issues by applying this dichotomy where it does not belong.

When we bestow existence upon a number it is not that the number is external to us and we internalize it or that it is internal and we merely externalize it. It is both external and internal. By bestowing existence upon it, we merely recognize it. In other words, it cannot be that, through interaction with us, the number changes its nature (from external to internal or the converse).

By merely realizing something and acknowledging this newfound knowledge, we do not change its nature. This is why meaning has nothing to do with existence, bestowed or not. Meaning is a human category. It is the name we give to the cognitive experience of shifting frames of reference. It has nothing to do with entities, only with us.

The world has no internal and external to it. Only we do. And when we bestow existence upon a number we only acknowledge its existence. It exists either as neural networks in our brains, or as some other entity (Platonic Idea). But, it exists and no amount of interactions with us, humans, is ever going to change this.

II. Why is Mathematics so Successful?

In earlier epochs, people used myths and religious narratives to encode all knowledge, even of a scientific and technological character. Words and sentences are still widely deployed in

many branches of the Humanities, the encroachment of mathematical modeling and statistics notwithstanding. Yet, mathematics reigns supreme and unchallenged in the natural sciences. Why is that? What has catapulted mathematics (as distinct from traditional logic) to this august position within three centuries?

Mathematics is a language like no other. Still, it suffers from the drawbacks that afflict other languages. The structure of our language, its inter-relatedness with the world, and its inherent limitations dictate our worldview and determine how we understand, describe and explain Nature and our place in it. Granted, languages are living things and develop constantly (consider slang, or the emergence of infinite numbers theories in mathematics). But, they evolve within a formal grammar and syntax, a logic, a straitjacket that inhibits thinking "outside the box" and renders impossible the faithful perception of "objective" reality.

So, what made mathematics so different and so triumphant?

1. It is a universal, portable, immediately accessible language that requires no translation. Idealists would say that it is intersubjectively shared. This may be because, as Kant and others have suggested, mathematics somehow relates to or is derived from a-priori structures embedded in the human mind.

2. It provides high information density, akin to stenography. Just a few symbols arranged in formulas and equations account for a wealth of experiences and encapsulate numerous observations. Mathematical concepts and symbols do not correspond to material objects or cause them, nor do they alter reality or affect it in any way, shape, or form. One cannot map a mathematical structure or construct or number or concept into the observed universe. This is because mathematics is not confined to describing what is, or what is necessarily so - it also limns what is possible, or provable.

3. Mathematics deals with patterns and laws. It can, therefore, yield predictions. Mathematics deals with forms and structures: some of these are in the material world, others merely in the mind of the mathematician.

4. Mathematics is a flexible, "open-source", responsive, and expandable language. Consider, for instance, how the introduction of the concept of the infinite and of infinite numbers was accommodated with relative ease despite the controversy and the threat this posed to the very foundations of traditional mathematics - or how mathematics ably progressed to deal with fuzziness and uncertainty.

5. Despite its aforementioned transigence, mathematics is invariant. A mathematical advance, regardless of how arcane or revolutionary, is instantly recognizable as such and can be flawlessly incorporated in the extant body of knowledge. Thus, the fluidity of mathematics does not come at the expense of its coherence and nature.

6. There is a widespread intuition or perception that mathematics is certain because it deals with a-priori knowledge and necessary truths (either objective and "out there", or mental, in the mind) and because it is aesthetic (like the mind of the Creator, the religious would add).

7. Finally, mathematics is useful: it works. It underlies modern science and technology unerringly and unfailingly. In time, all branches of mathematics, however obscure, prove to possess practical applications.

III. Forms, Pattern, and Substance

We cannot conceive of any process of production without the dubious aid of the Watchmaker's Metaphor: an artisan; a plan, or program, or procedure; raw materials, or inputs; and the finished product – all four elements distinct from one another. Yet, in nature, this division of labor is rarely true: in the vast majority of cases the raw materials and the program are one and the same and the artisan is missing altogether.

This discrepancy between our intuition and reality is so bothersome that even talented scientists, such as Rupert Sheldrake, were forced to resort to pseudoscience to reconcile it. His concept of "morphic fields" that dictate both the structure and functions of "morphic units" via a kind of "morphic resonance" and are formed by repetition of acts or thoughts is nothing short of mystic: it is unfalsifiable and, therefore, unscientific.

But dismissing Sheldrake's fields and Jung's "collective consciousness" leaves important questions unanswered: Why (not how) do stem cells and embryonic cells differentiate and grow into separate, highly-specific organs during the phases of embryogenesis or, later and in some animals, metamorphosis? How do animal colonies, flocks, and shoals form and function? Why and how do crystals "choose" to develop into specific forms rather than others, equally possible and "permissible" under the laws of physics? What is the organizing principle that guides the formation of neural networks and axon pathfinding (guidance)?

In other words: are Forms (and, by extension: functions) somehow predetermined, "out there", hylomorphically (as Plato, Aristotle, and, to some extent Leibniz suggested)? Are there potentials or "fields" that attract matter and energy and mold them into objects and processes (including mental processes)? And, if so, what decides in favour of certain forms (or "ideals" or "ideas") and not others? Discarding the religious response ("divine intervention") and the mystic solutions (such as the "Akashic records"), we find to our consternation that we are left with no answer at all.

To say, as science does, that the Laws of Nature yield "self-organization", or "self-assembly" is an embarrassing tautology (not to say teleology). To attribute pattern formation to regulatory or inhibitory molecular or chemical cues in the environment, to signalling, cell fates, or, in scientists' favourite phrase, to a "developmental induction cascade" is to confuse the "how" with the "why" and the "how come". Stating the obvious as did Adrian Bejan with his Constructal "Law" (which postulates that finite-size systems evolve to provide easier access to imposed currents that flow through them) does nothing to further our fundamental insight of the world.

Spontaneous order via stigmergy and sematectony, emergence (emergentism), connectionism, epiphenomenalism and, more generally, synergetics are even more circular and "magical" propositions: descriptive and phenomenological, they may well amount to mere language constructs. These approaches definitely add nothing to our understanding of the presumably causative chains underlying the sudden appearance of novel, coherent (or correlated), macro, dynamical, supervenient (the system supervenes its components), and ostensive patterns, behaviors, and properties.

We are supposed to believe that, somehow, the system – an abstract notion, wholly in the mind of its human promulgators - interacts with its environment and that context thus dictates

the behavior at the micro level. Such models require a leap of faith and a suspension of scientific judgement. In defending them, Peter Corning was reduced to introducing a deus-ex-machina (the consciousness of chess players) through the back door to fully explicate emergence, for instance.

Clearly, to merely re-label and name the mystery does not make it go away. Nor can such fancy verbalizing disguise our fundamental ignorance regarding emergent order in phenomena as varied as bacteria cultures; swarm intelligence; the distribution of vegetation; foams, crystals, and flakes; and chemical and Turing patterns (e.g., the Belousov-Zhabotinsky reaction).

Instances of this propensity of modern thinkers to obscure rather than elucidate abound: Evolutionary Development's resurrected concept of morphogenetic fields (or units), or the incorporation of lattices in partial differential equations that describe dynamical evolving systems (e.g. in the Swift-Hohenberg equation) are only marginally more rigorous than Sheldrake's concept of morphic fields in that they fail to convincingly account for, respectively, ***why*** cells develop into specific organs even when they are mishandled and transplanted and why hysteresis arises in convection experiments.

What is it that tells cells to develop into a specific part of the organism and, equally important, to not develop into another? What is the source of their deterministic lack of "hesitation" and their directional "decisiveness"? And where does the path dependence spring from in certain physical systems?

Back to our initial question:

Is there anything ***external*** or extraneous involved in these mind-boggling processes of morphogenesis and differentiation (except the signalling biochemicals which constitute an integral part of the system?) Genes (DNA), morphogens, adhesion molecules, transcription proteins, the extracellular matrix, and hormones cannot by any stretch of the word be perceived as ***outside*** the largely autopoietic systems they control. Environmental chemicals and mechanical stresses are external, but it is difficult to understand why they trigger specific morphogenetic configurations and not others and, even so, they account for a minority of mutations and occurrences.

But isn't this whole self-contained unfolding reminiscent of a computer? After all: computers do run programs which are resident (internal). But here the parallels break: programs are written by programmers; chips are designed, manufactured, and assembled by armies of humans and machines; and input is provided yet again either by users or by other computing platforms. All these are external and independent agents.

To further complicate matters, "morphic units" (for want of a better term) such as cells or crystals comport themselves variably in identical circumstances. Consider axons for instance: their growth cones (which sense and react to gradients of biochemicals in the extracellular environment) respond differently in different times to the same cues, depending on previous exposure and habituation, timing, and physiological context. So, if there is a guiding principle, a matrix, field, template, lattice or structure "out there", it must be changing constantly to allow for these idiosyncratic reactions.

Why do we discern forms, patterns, and order everywhere? Because this ability to reorganize our perceptions of reality into predictable moulds and sequences bestows on us untold evolutionary advantages and has an immense survival value. Consequently, we compulsively read configurations and patterns even onto completely random sets of data. The way we perceive holes and other immaterial disruptions as structured entities attests to our "addiction to order and regularity" even where there is only nothing and nothingness.

Why do we all seem to spot essentially ***the same*** forms, patterns, and evolving order? Simply because we are possessed of largely identical hardware and software: wetware, our brains. We function well on the basis of these shared perceptions. Even so, the limitations of intersubjectivity mean that we can never ***prove*** that we experience the world in the same way: observers may perceive the colour red or the sensation of pain identically or differently. We simply don't know.

Moreover: beings equipped with other types of processing units, or even different eyes (with a much faster or slower blink rate, or an extended exposure to light), or creatures which use other segments of the electromagnetic spectrum for information gathering are bound to descry the world entirely differently with none of the forms, patterns, and order that we impose on it.

Yet, surely we can construct dictionaries to translate the observations of such alien beings and creatures and to reduce their perceptions, mathematics and physics, geometry, and biology into our own? Maybe so. There is no way to prove that all experiences are reducible and translatable to one another and that all perceptions and concepts can be mapped regardless of the qualities and parameters of the sensory organs that give rise to them in the first place.

Even if they were, the way we experience the Universe would still be vastly different to the subjective, inner landscape of beings or creatures with an unfathomably disparate sensorium, brain, and conceptual space: different to the point of being incommunicable. Even within our species, certain people – the mystics – resort to hermetic and hermeneutically-inaccessible private languages to describe their experiences. With such barriers afoot, we will never be able to ascertain that any translation, reduction, or mapping that we engage in is valid: the subjective dimensions or components of any complete knowledge of the world are as important as the objective ones. Absent operational intersubjectivity, we can never be sure that our knowledge of reality is the same as someone else's, let alone an extraterrestrial.

Churchfield commented astutely in 1994:

"Defining structure and detecting the emergence of complexity in nature are inherently subjective, though essential, scientific activities. Despite the difficulties, these problems can be analysed in terms of how model-building observers infer from measurements the computational capabilities embedded in non-linear processes. An observer's notion of what is ordered, what is random, and what is complex in its environment depends directly on its computational resources: the amount of raw measurement data, of memory, and of time available for estimation and inference. The discovery of structure in an environment depends more critically and subtly, though, on how those resources are organized. The descriptive power of the observer's chosen (or implicit) computational model class, for example, can be an overwhelming determinant in finding regularity in data."

Still, regardless of ***what*** or ***how*** we perceive - is there some ***thing*** out there? Are we hallucinating when we refer to external entities, bodies, objects, events, and processes?

It is parsimonious to assume that there is an objective reality, independent of any and all observers. But, to account for all its manifestations and for our perceptions of it, such reality must be multifarious. We seem to ***select*** the forms and patterns that we see by collapsing a kind of superpositioned uber-wave function of all potential forms and patterns. Indeed, we ***choose*** the Universe, we do not observe it.

We do not ***create*** it, though (as the Copenhagen interpretation of Quantum Mechanics and some solipsistic epistemologies would have us believe): all the potential forms and patterns (one is almost tempted to say entelechies or monads had it not been for their teleological connotations) do really, independently, objectively and deterministically co-exist both spatially and temporally. The solutions to the wave function with the highest probabilities are the ones we encounter (select) most often. The less probable outcomes we call "mutations" (in biology) or "freak occurrences" (in statistics) or "exceptions" (to rules.)

It stands to reason that bifurcation (catastrophe), singularity, and chaos theories should be able to provide a precise account of the way that we dynamically affect our choices. Indeed, the entire Universe may be conceived as being in states of quenched, or (truer to reality) annealed order with the observers as its random variables. Alternatively, the Universe and the Observer can be viewed as states with differing topological orders and the collapse of the wave function as a phase transition from one to the other. It can be shown that this kind of description naturally gives rise to a Multiverse characterized by topological entropy.

Thus, we are back to where we started: there is no need for "morphic fields" or "morphic resonance" out there because forms and patterns are all "in our head", mere conventions, akin to Time. All forms and patterns co-exist as potentials and the observer determines which ones are best suited to his needs and predilections, biases and sensory equipment, processor and language (or meta-language).

The observer imposes his choices and selections by ignoring certain potentials (options) and by using the selected forms and patterns as organizing and exegetic principles. The history of science is full of paradigm shifts: collective transitions from one set of forms and patterns to another, adopted as the new preferred frame of reference. Not idealism, therefore ("reality is heavily dependent on our mental activity, perhaps to the point of not having an independent, absolute existence"), but some kind of a theory of filtering: the world is out there and we slice and dice and order it to fit our limitations.

IV. Teleology

In his book, ***Global Brain: The Evolution of Mass Mind from the Big Bang to the 21st Century***, published in 2002, Howard Bloom suggests that all the organisms on the planet contribute to a pool of knowledge and, thus, constitute a "global brain". He further says that different life-forms "strike deals" to modify their "behavior" and traits and thus be of use to each other.

This is a prime example of teleology (and, at times, tautology). It anthropomorphesizes nature by attributing to plants, bacteria, and animals human qualities such as intelligence, volition, intent, planning, foresight, and utilitarian thinking. The source of the confusion is in the misidentification of cause and effect.

Organisms do "collaborate" in one of these ways:

(i) **Co-existence** - They inhabit the same eco-system but do not interact with each other

(ii) **Food Chain** - They occupy the same eco-system but feed on each other

(iii) **Maintenance** - Some organisms maintain the life and facilitate the reproduction of others, but can survive, or even do well, without the maintained subspecies, though the reverse is not true.

(iv) **Enablement or Empowerment** - The abilities and powers of some organisms are enhanced or extended by other species, but they can survive or even do well even without such enhancement or extension.

(v) **Symbiosis** - Some organisms are dependent on each other for the performance of vital functions. They cannot survive, reproduce, or thrive for long without the symbiont.

Clearly, these arrangements superficially resemble human contracting - but they lack the aforementioned human inputs of volition, foresight, or planning. Is Nature as a whole intelligent (as we humans understand intelligence)? Was it designed by an intelligent being (the "watchmaker" hypothesis)? If it was, is each and every part of Nature endowed with this "watchmaker" intelligence?

The word "telos" in ancient Greek meant: "goal, target, mission, completion, perfection". The Greeks seem to have associated the attaining of a goal with perfection. Modern scientific thought is much less sanguine about teleology, the belief that causes are preceded by their effects.

The idea of reverse causation is less zany than it sounds. It was Aristotle who postulated the existence of four types of causes. It all started with the attempt to differentiate explanatory theories from theories concerning the nature of explanation (and the nature of explanatory theories).

To ***explain*** is to provoke an understanding in a listener as to why and how something is as it is. Thales, Empedocles and Anaxagoras were mostly concerned with offering explanations to natural phenomena. The very idea that there must be an explanation is revolutionary. We are so used to it that we fail to see its extraordinary nature. Why not assume that everything is precisely as it is simply because this is how it should be, or because there is no better way (Leibnitz), or because someone designed it this way (religious thought)?

Plato carried this revolution further by seeking not only to explain things, but also to construct a systematic, connective epistemology. His Forms and Ideas are (not so primitive) attempts to elucidate the mechanism which we employ to cope with the world of things, on the one hand, and the vessels through which the world impresses itself upon us, on the other hand.

Aristotle made this distinction explicit: he said that there is a difference between the chains of causes of effects (what leads to what by way of causation) and the enquiry regarding the very nature of causation and causality.

In this text, we will use the word causation in the sense of: "the action of causes that brings on their effects" and causality as: "the relation between causes and their effects".

Studying this subtle distinction, Aristotle came across his "four causes". All, according to him, could be employed in explaining the world of natural phenomena. This is his point of departure from modern science. Current science does not admit the possibility of a final cause in action.

But, first things first. The formal cause is why a thing is the type of thing that it is. The material cause is the matter in which the formal cause is impressed. The efficient cause is what produces the thing that the formal and the material causes conspire to yield. It is the final cause that remotely drives all these causes in a chain. It is "that for the sake of which" the thing was produced and, as a being, acts and is acted upon. It is to explain the coming to being of the thing by relating to its purpose in the world (even if the purpose is not genuine).

It was Francis Bacon who set the teleological explanations apart from the scientific ones.

There are forms and observed features or behaviours. The two are correlated in the shape of a law. It is according to such a law, that a feature happens or is caused to happen. The more inclusive the explanation provided by the law, the higher its certainty.

This model, slightly transformed, is still the prevailing one in science. Events are necessitated by laws when correlated with a statement of the relevant facts. Russel, in Hume's footsteps, gave a modern dress to his constant conjunction : such laws, he wrote, should not provide the details of a causal process, rather they should yield a table of correlations between natural variables.

Hume said that what we call "cause and effect" is a fallacy generated by our psychological propensity to find "laws" where there are none. A relation between two events, where one is always conjoined by the other is called by us "causation". But that an event follows another invariably - does not prove that one is the other's cause.

Yet, if we ignore, for a minute, whether an explanation based on a final cause is at all legitimate in the absence of an agent and whether it can at all be a fundamental principle of nature - the questions remains whether a teleological explanation is possible, sufficient, or necessary?

It would seem that sometimes it is. From Kip Thorne's excellent tome "Black Holes and Tim Warps" (Papermac, 1994, page 417):

"They (the physicists Penrose and Israel - SV) especially could not conceive of jettisoning it in favour of the absolute horizon (postulated by Hawking - SV). Why? Because the absolute horizon - paradoxically, it might seem - violates our cherished notion that an effect should not precede its cause. When matter falls into a black hole, the absolute horizon starts to grow ("effect") before the matter reaches it ("cause"). The horizon grows in anticipation that the matter will soon be swallowed and will increase the hole's gravitational pull... Penrose and Israel knew the origin of seeming paradox. The very definition of the absolute horizon depends on what will happen in the future: on whether or not signals will ultimately escape to the distant Universe. In the terminology of philosophers, it is a teleological definition (a definition that relies on "final causes"), and it forces the horizon's evolution to be teleological. Since teleological viewpoints have rarely if ever been useful in modern physics, Penrose and Israel were dubious about the merits of the absolute horizon... (page 419) Within a few months, Hawking and James Hartle were

able to derive, from Einstein's general relativity laws, a set of elegant equations that describe how the absolute horizon continuously and smoothly expands and changes its shape, in anticipation of swallowing infalling debris or gravitational waves, or in anticipation of being pulled on by the gravity of other bodies."

The most famous teleological argument is undoubtedly the "design argument" in favour of the existence of God. Could the world have been created accidentally? It is ordered to such an optimal extent, that many find it hard to believe. The world to God is what a work of art is to the artist, the argument goes. Everything was created and "set in motion" with a purpose in (God's) mind. The laws of nature are goal-oriented.

It is a probabilistic argument: the most plausible explanation is that there is an intelligent creator and designer of the Universe who, in most likelihood, had a purpose, a goal in mind. What is it that he had in mind is what religion and philosophy (and even science) are all about.

A teleological explanation is one that explains things and features while relating to their contribution to optimal situations, or to a normal mode of functioning, or to the attainment of goals by a whole or by a system to which the said things or features belong.

Socrates tried to understand things in terms of what good they do or bring about. Yet, there are many cases when the contribution of a thing towards a desired result does not account for its occurrence. Snow does not fall ***IN ORDER*** to allow people to ski, for instance.

But it is different when we invoke an intelligent creator. It can be convincingly shown that such a creator designed and maintained the features of an object in order to allow it to achieve an aim. In such a case, the very occurrence, the very existence of the object is explained by grasping its contribution to the attainment its function.

An intelligent agent (creator) need not necessarily be a single, sharply bounded, entity. A more fuzzy collective may qualify as long as its behaviour patterns are cohesive and identifiably goal oriented. Thus, teleological explanations could well be applied to organisms (collections of cells), communities, nations and other ensembles.

To justify a teleological explanation, one needs to analyse the function of the item to be explained, on the one hand - and to provide an etiological account, on the other hand. The

functional account must strive to explain what the item contributes to the main activity of the system, the object, or the organism, a part of which it constitutes - or to their proper functioning, well-being, preservation, propagation, integration (within larger systems), explanation, justification, or prediction.

The reverse should also be possible. Given knowledge regarding the functioning, integration, etc. of the whole - the function of any element within it should be derivable from its contribution to the functioning whole. Though the practical ascription of goals (and functions) is problematic, it is, in principle, doable.

But it is not sufficient. That something is both functional and necessarily so does not yet explain ***HOW*** it happened to have so suitably and conveniently materialized. This is where the etiological account comes in. A good etiological account explains both the mechanisms through which the article (to be explained) has transpired and what aspects of the structure of the world it was able to take advantage of in its preservation, propagation, or functioning.

The most famous and obvious example is evolution. The etiological account of natural selection deals both with the mechanisms of genetic transfer and with the mechanisms of selection. The latter bestow upon the organism whose feature we seek to be explain a better chance at reproducing (a higher chance than the one possessed by specimen without the feature).

Throughout this discussion, it would seem that a goal necessarily implies the existence of an intention (to realize it). A lack of intent leaves only one plausible course of action: automatism. Any action taken in the absence of a manifest intention to act is, by definition, an automatic action.

The converse is also true: automatism prescribes the existence of a sole possible mode of action, a sole possible Nature. With an automatic action, no choice is available, there are no degrees of freedom, or freedom of action. Automatic actions are, ipso facto, deterministic.

But both statements may be false. Surely we can conceive of a goal-oriented act behind which there is no intent of the first or second order. An intent of the second order is, for example, the intentions of the programmer as enshrined and expressed in a software application. An intent of the first order would be the intentions of the same programmer which directly lead to the composition of said software.

Still, the distinction between volitional and automatic actions is not clear-cut.

Consider, for instance, house pets. They engage in a variety of acts. They are goal oriented (seek food, drink, etc.). Are they possessed of a conscious, directional, volition (intent)? Many philosophers argued against such a supposition. Moreover, sometimes end-results and by-products are mistaken for goals. Is the goal of objects to fall down? Gravity is a function of the structure of space-time. When we roll a ball down a slope (which is really what gravitation is all about, according to the General Theory of Relativity) is its "goal" to come to a rest at the bottom? Evidently not.

Still, some natural processes are much less evident. Natural processes are considered to be witless reactions. No intent can be attributed to them because no intelligence can be ascribed to them. This is true but only at times.

Intelligence is hard to to define. Still, the most comprehensive approach would be to describe it as the synergetic sum of a host of mental processes (some conscious, some not). These mental processes are concerned with information: its gathering, its accumulation, classification, inter-relation, association, analysis, synthesis, integration, and all other modes of processing and manipulation.

But is this not what natural processes are all about? And if nature is the sum total of all natural processes, aren't we forced to admit that nature is (intrinsically, inherently, of itself) intelligent? The intuitive reaction to these suggestions is bound to be negative. When we use the term "intelligence", we seem not to be concerned with just any kind of intelligence - but with intelligence that is separate from and external to what has to be explained. If both the intelligence and the item that needs explaining are members of the same set, we tend to disregard the intelligence involved and label it as "natural" and, therefore, irrelevant.

Moreover, not everything that is created by an intelligence (however "relevant", or external) is intelligent in itself. Some automatic products of intelligent beings are inanimate and non-intelligent. On the other hand, as any Artificial Intelligence buff would confirm, automata can become intelligent, having crossed a certain quantitative or qualitative level of complexity. The weaker form of this statement is that, beyond a certain quantitative or qualitative level of complexity, it is impossible to tell the automatic from the intelligent. Is Nature automatic, is it intelligent, or on the seam between automata and intelligence?

Nature contains everything and, therefore, contains multiple intelligences. That which contains intelligence is not necessarily intelligent, unless the intelligences contained are

functional determinants of the container. Quantum mechanics (rather, its Copenhagen interpretation) implies that this, precisely, is the case. Intelligent, conscious, observers determine the very existence of subatomic particles, the constituents of all matter-energy. Human (intelligent) activity determines the shape, contents and functioning of the habitat Earth. If other intelligent races populate the universe, this could be the rule, rather than the exception. Nature may, indeed, be intelligent.

Jewish mysticism believes that humans have a major role: fixing the results of a cosmic catastrophe, the shattering of the divine vessels through which the infinite divine light poured forth to create our finite world. If Nature is determined to a predominant extent by its contained intelligences, then it may well be teleological.

Indeed, goal-orientated behaviour (or behavior that could be explained as goal-orientated) is Nature's hallmark. The question whether automatic or intelligent mechanisms are at work, really deals with an underlying issue, that of consciousness. Are these mechanisms self-aware, introspective? Is intelligence possible without such self-awareness, without the internalized understanding of what it is doing?

Kant's third and the fourth dynamic antinomies deal with this apparent duality: automatism versus intelligent acts.

The third thesis relates to causation which is the result of free will as opposed to causation which is the result of the laws of nature (nomic causation). The antithesis is that freedom is an illusion and everything is pre-determined. So, the third antinomy is really about intelligence that is intrinsic to Nature (deterministic) versus intelligence that is extrinsic to it (free will).

The fourth thesis deals with a related subject: God, the ultimate intelligent creator. It states that there must exist, either as part of the world or as its cause a Necessary Being. There are compelling arguments to support both the theses and the antitheses of the antinomies.

The opposition in the antinomies is not analytic (no contradiction is involved) - it is dialectic. A method is chosen for answering a certain type of questions. That method generates another question of the same type. "The unconditioned", the final answer that logic demands is, thus, never found and endows the antinomy with its disturbing power. Both thesis and antithesis seem true.

Perhaps it is the fact that we are constrained by experience that entangles us in these intractable questions. The fact that the causation involved in free action is beyond possible experience does not mean that the idea of such a causality is meaningless.

Experience is not the best guide in other respects, as well. An effect can be caused by many causes or many causes can lead to the same effect. Analytic tools - rather than experiential ones - are called for to expose the "true" causal relations (one cause-one effect).

Experience also involves mnemic causation rather than the conventional kind. In the former, the proximate cause is composed not only of a current event but also of a past event. Richard Semon said that mnemic phenomena (such as memory) entail the postulation of engrams or intervening traces. The past cannot have a direct effect without such mediation.

Russel rejected this and did not refrain from proposing what effectively turned out to be action at a distance. This is not to mention backwards causation. A confession is perceived by many to annul past sins. This is the Aristotelian teleological causation. A goal generates a behaviour. A product of Nature develops as a cause of a process which ends in it (a tulip and a bulb).

Finally, the distinction between reasons and causes is not sufficiently developed to really tell apart teleological from scientific explanations. Both are relations between phenomena ordained in such a way so that other parts of the world are effected by them. If those effected parts of the world are conscious beings (not necessarily rational or free), then we have "reasons" rather than "causes".

But are reasons causal? At least, are they concerned with the causes of what is being explained? There is a myriad of answers to these questions. Even the phrase: "Are reasons causes?" may be considered to be a misleading choice of words. Mental causation is a foggy subject, to put it mildly.

Perhaps the only safe thing to say would be that causes and goals need not be confused. One is objective (and, in most cases, material), the other mental. A person can act in order to achieve some future thing but it is not a future cause that generates his actions as an effect. The immediate causes absolutely precede them. It is the past that he is influenced by, a past in which he formed a ***VISION*** of the future.

The contents of mental imagery are not subject to the laws of physics and to the asymmetry of time. The physical world and its temporal causal order are. The argument between teleologists and scientist may, all said and done, be merely semantic. Where one claims an ontological, ***REAL*** status for mental states (reasons) - one is a teleologist. Where one denies this and regards the mental as ***UNREAL***, one is a scientist.

V. Notes on Complexity

Complexity arises spontaneously in nature through processes such as critical self-organization. Emergent phenomena are common as are emergent traits, not reducible to basic components, interactions, or properties.

Complexity does not, therefore, imply the existence of a designer or a design. Complexity does not imply the existence of intelligence and sentient beings. On the contrary, complexity usually points towards a natural source and a random origin. Complexity and artificiality are often incompatible.

Artificial designs and objects are found only in unexpected ("unnatural") contexts and environments. Natural objects are totally predictable and expected. Artificial creations are efficient and, therefore, simple and parsimonious. Natural objects and processes are not.

As Seth Shostak notes in his excellent essay, titled "SETI and Intelligent Design", evolution experiments with numerous dead ends before it yields a single adapted biological entity. DNA is far from optimized: it contains inordinate amounts of junk. Our bodies come replete with dysfunctional appendages and redundant organs. Lightning bolts emit energy all over the electromagnetic spectrum. Pulsars and interstellar gas clouds spew radiation over the entire radio spectrum. The energy of the Sun is ubiquitous over the entire optical and thermal range. No intelligent engineer - human or not - would be so wasteful.

Confusing artificiality with complexity is not the only terminological conundrum.

Complexity and simplicity are often, and intuitively, regarded as two extremes of the same continuum, or spectrum. Yet, this may be a simplistic view, indeed.

Simple procedures (codes, programs), in nature as well as in computing, often yield the most complex results. Where does the complexity reside, if not in the simple program that created it? A minimal number of primitive interactions occur in a primordial soup and, presto, life. Was life somehow embedded in the primordial soup all along? Or in the interactions? Or in the combination of substrate and interactions?

Complex processes yield simple products (think about products of thinking such as a newspaper article, or a poem, or manufactured goods such as a sewing thread). What happened to the complexity? Was it somehow reduced, "absorbed, digested, or assimilated"? Is it a general rule that, given sufficient time and resources, the simple can become complex and the complex reduced to the simple? Is it only a matter of computation?

We can resolve these apparent contradictions by closely examining the categories we use.

Perhaps simplicity and complexity are categorical illusions, the outcomes of limitations inherent in our system of symbols (in our language).

We label something "complex" when we use a great number of symbols to describe it. But, surely, the choices we make (regarding the number of symbols we use) teach us nothing about complexity, a real phenomenon!

A straight line can be described with three symbols (A, B, and the distance between them) - or with three billion symbols (a subset of the discrete points which make up the line and their inter-relatedness, their function). But whatever the number of symbols we choose to employ, however complex our level of description, it has nothing to do with the straight line or with its "real world" traits. The straight line is not rendered more (or less) complex or orderly by our choice of level of (meta) description and language elements.

The simple (and ordered) can be regarded as the tip of the complexity iceberg, or as part of a complex, interconnected whole, or hologramically, as encompassing the complex (the same way all particles are contained in all other particles). Still, these models merely reflect choices of descriptive language, with no bearing on reality.

Perhaps complexity and simplicity are not related at all, either quantitatively, or qualitatively. Perhaps complexity is not simply more simplicity. Perhaps there is no organizational principle tying them to one another. Complexity is often an emergent phenomenon, not reducible to simplicity.

The third possibility is that somehow, perhaps through human intervention, complexity yields simplicity and simplicity yields complexity (via pattern identification, the application of

rules, classification, and other human pursuits). This dependence on human input would explain the convergence of the behaviors of all complex systems on to a tiny sliver of the state (or phase) space (sort of a mega attractor basin). According to this view, Man is the creator of simplicity and complexity alike but they do have a real and independent existence thereafter (the Copenhagen interpretation of a Quantum Mechanics).

Still, these twin notions of simplicity and complexity give rise to numerous theoretical and philosophical complications.

Consider life.

In human (artificial and intelligent) technology, every thing and every action has a function within a "scheme of things". Goals are set, plans made, designs help to implement the plans.

Not so with life. Living things seem to be prone to disorientated thoughts, or the absorption and processing of absolutely irrelevant and inconsequential data. Moreover, these laboriously accumulated databases vanish instantaneously with death. The organism is akin to a computer which processes data using elaborate software and then turns itself off after 15-80 years, erasing all its work.

Most of us believe that what appears to be meaningless and functionless supports the meaningful and functional and leads to them. The complex and the meaningless (or at least the incomprehensible) always seem to resolve to the simple and the meaningful. Thus, if the complex is meaningless and disordered then order must somehow be connected to meaning and to simplicity (through the principles of organization and interaction).

Moreover, complex systems are inseparable from their environment whose feedback induces their self-organization. Our discrete, observer-observed, approach to the Universe is, thus, deeply inadequate when applied to complex systems. These systems cannot be defined, described, or understood in isolation from their environment. They are one with their surroundings.

Many complex systems display emergent properties. These cannot be predicted even with perfect knowledge about said systems. We can say that the complex systems are creative and intuitive, even when not sentient, or intelligent. Must intuition and creativity be predicated on intelligence, consciousness, or sentience?

Thus, ultimately, complexity touches upon very essential questions of who we, what are we for, how we create, and how we evolve. It is not a simple matter, that...

VI. Ambiguity and Vagueness

Ambiguity (or indeterminacy, in deconstructivist parlance) is when a statement or string (word, sentence, theorem, or expression) has two or more distinct meanings either lexically (e.g., homonyms), or because of its grammar or syntax (e.g., amphiboly). It is the context, which helps us to choose the right or intended meaning ("contextual disambiguating" which often leads to a focal meaning).

Vagueness arises when there are "borderline cases" of the existing application of a concept (or a predicate). When is a person tall? When does a collection of sand grains become a heap (the sorites or heap paradox)?, etc. Fuzzy logic truth values do not eliminate vagueness - they only assign continuous values ("fuzzy sets") to concepts ("prototypes").

Open texture is when there may be "borderline cases" in the future application of a concept (or a predicate). While vagueness can be minimized by specifying rules (through precisifaction, or supervaluation) - open texture cannot because we cannot predict future "borderline cases".

It would seem that a complexity theory formalism can accurately describe both ambiguity and vagueness:

Language can be construed as a self-organizing network, replete with self-organized criticality.

Language can also be viewed as a Production System (Iterated Function Systems coupled with Lindenmeyer L-Systems and Schemas to yield Classifiers Systems). To use Holland's vocabulary, language is a set of Constrained Generating Procedures.

"Vague objects" (with vague spatial or temporal boundaries) are, actually, best represented by fractals. They are not indeterminate (only their boundaries are). Moreover, self-similarity is maintained. Consider a mountain - where does it start or end and what, precisely, does it include? A fractal curve (boundary) is an apt mathematical treatment of this question.

Indeterminacy can be described as the result of bifurcation leading to competing, distinct, but equally valid, meanings.

Borderline cases (and vagueness) arise at the "edge of chaos" - in concepts and predicates with co-evolving static and chaotic elements.

(Focal) meanings can be thought of as attractors.

Contexts can be thought of as attractor landscapes in the phase space of language. They can also be described as fitness landscapes with optimum epistasis (interdependence of values assigned to meanings).

The process of deriving meaning (or disambiguating) is akin to tracing a basin of attraction. It can be described as a perturbation in a transient, leading to a stable state.

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